# Nanostructured Active Biomaterials for Tissue Engineering Applications

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## Abstract

In recent years, considerable effort has been devoted to the design and controlled fabrication of structured materials with functional properties. The layer by layer buildup of polyelectrolyte multilayer films (PEM films) from oppositely charged polyelectrolytes1 offers new opportunities for the preparation of functionalized biomaterial coatings. This technique allows the preparation of supramolecular nano-architectures exhibiting specific properties in terms of control of cell activation and may also play a role in the development of local drug delivery systems. Peptides, proteins, drugs or DNA, chemically bound to polyelectrolytes or Cyclodextrins (CDs), adsorbed or embedded in PEM films, have been shown to retain their biological activities[2-12]. Recently, we have demonstrated for the first time the sequential induction of nuclear and /or cytoplasmic expression products, mediated by β-cyclodextrin embedded in a PEM film[7].

In recent times, tissue engineering has merged with stem cell technology with interest to develop new sources of transplantable material for injury or disease treatment. Eminently interesting, are bone and joint injuries disorders because of the low self-regenerating capacity of the matrix secreting cells. We present here for the first time that embedded BMP-2 and CDs-TGFβ$_1$ in a multilayered polyelectrolyte film can drive embryonic stem cells to the cartilage or bone differentiation depending on supplementary co-factors. We selected a model system made from layer by layer poly-ℓ-glutamic acid (PℓGA) and poly-ℓ-lysine succinylated (PℓLs) films into which BMP-2 and CDs-TGFβ$_1$ have been embedded. Our results demonstrate clearly that we are able to induce osteogenesis in embryonic stem cells mediated by growth factors embedded in a polyelectrolyte multilayer film [8].

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